

**REMARKS**

Claims 1-40 are pending. Claims 1, 2, 18, 27, 28 and 32 are amended. Claims 34-40 are added. No new matter is submitted. Accordingly, entry of the Amendment is respectfully requested.

Applicants' appreciate the indication in item 14 of the Office Action of claims 4, 5, 10, 11, 13 and 26 as being allowable if rewritten into independent form including all of the limitations of the base claim and any intervening claims. New claims 35-40 are entered herein and correspond to the subject matter of claims 4, 5, 10, 11, 13 and 26 respectively. Accordingly, it is respectfully submitted that claims 35-40 should be allowed.

In item 1 of the Office Action, claims 28, 29 and 31 are objected to as allegedly duplicates of claim 27 when claim 27 depends from claim 5, 18 or 23. The objection is respectfully traversed. Claim 27 now depends from claim 1 and the scope of claims 1 and 28 are not the same.

Independent claim 1 has been amended to further clarify the invention and further distinguish it from the art. The phrase "salient portions" has been changed to "projections" for appropriate consistency in the claims. Additionally, the claim recites that the "projections.... extend into and mechanically lock over the other of the mating surfaces." Support for this limitation may be seen for example in Figure 7 and the specification at page 6, line 29 - page 7, line 2; page 6, line 20-22 and page 4, line 2.

Independent claim 18 now specifies that the tips of the salient portions from an angled mechanical locking grip over the other material. This amendment finds support as set forth in the preceding paragraph.

Claim 28 now mentions first and second re-entrant angles corresponding to the re-entrant portions of the edges and tips shown clearly in Figure 7 and described at page 6, line 23, and page 7, line 2.

New claim 34 indicates that the salient portions extend into the mating surface and extend back toward the other surface. This finds support at the same specification locations mentioned above in conjunction with independent claim 1.

In item 3 of the Office Action, claims 1, 8, 12, 14-22, 27, 29, 32 and 33 are rejected under 35 U.S.C. 102 (b) as allegedly anticipated by Fan (US Patent No. 5,269,899). The rejection is respectfully traversed.

To maintain a 35 U.S.C. 102 (b) rejection a reference must teach each and every feature of the claimed invention. Fan does not do so.

Applicants' invention is directed toward low temperature sputter target/backing plate bonding methods and assemblies made thereby. In accordance with the invention, low melting point targets, such as aluminum and copper, are successfully bonded to associated backing plate members at low temperatures. Despite the low temperature bonding methods used, the bonds formed are strong and display enhanced shear resistance. The sputter target assemblies can thus be used at high operating power and temperatures. Further the undesirable grain growth of the target is minimized due to the low temperature bonding.

Fan discloses a target 100 and backing plate 200, each provided with a plurality of teeth 140, 240, wherein one of the target and backing plate is concave (col. 6, lines 6-10 & 19-23) in order to offset the bowing that often occurs by the cooling water applied to the backing plate (col. 5, lines 49-52). The plurality of teeth 140, 240 of Fan are pressed together and twisted (col. 4, lines 48-54) in order to friction fit the target and backing plate together. As thermal expansion occurs during sputtering, the teeth expand causing greater engagement between the teeth and more effective heat transfer (col. 5, lines 12-16). The teeth 140 and 240 in Fan never penetrate or extend into the opposing interfacial surface via first and second re-entrant angles as do the edge and tip recited in claim 28 of Applicants' invention. Nor is there any suggestion to do so in Fan as the teeth are used to merely expand and abut one another during increased thermal conditions during sputtering in order to engage one another and to effect greater heat transfer.

Accordingly, Fan is deficient in making any hint or suggestion of the features of the independent claims as indicated.

Deficiencies of Fan

Independent claim 1

- (1) Fan makes no suggestion of the low (i.e. less than 38°C) temperature pressure consolidation.
- (2) Fan does not suggest projections that extend into and mechanically lock over the other of the mating surfaces.

Independent claim 18

- (1) No hint or suggestion of consolidation at temperatures less than about 50% of the lower member's melting point.
- (2) No hint or suggestion of deforming at least one edge of the salient portion to form a re-entrant edge angle wherein the tip forms an angled mechanical locking grip over the other material.

Independent claim 28

- (1) No suggestion of a first and second re-entrant angled edge and tip respectively.

Independent claim 34

- (1) No suggestion that salient portion extends back toward the other mating surface, and
- (2) No suggestion of pressure consolidation under low temperature conditions.

In item 4 of the Office Action, claims 1, 12, 14-21, 27-29 and 33 are rejected under 35 U.S.C. 102(b) as allegedly anticipated by Boys (US Patent No. 5,215,639). The rejection is respectfully traversed.

Boys discloses a target 7 and backing plate 1 having complimentary contoured surfaces, wherein the contoured surface of the backing plate corresponds to the eventual end-of-life shape of the target after use (col. 6, lines 12-24). The target and backing plate are then pressed together using hot or cold pressing techniques (col. 6, lines 50-60). Boys fails to teach, disclose or suggest the following:

**Deficiencies of Boys**

**Independent claim 1**

No suggestion of projection that extends into and mechanically locks over the other surface.

**Independent claim 18**

No suggestion of the deformation of edge and tip as recited.

**Independent claim 28**

No suggestion of edge and tip formation as recited.

**Independent claim 34**

No suggestion of extension back of the salient portions toward the other mating surface at the specified re-entrant angle.

In item 5 of the Office Action, claims 1, 27, 28 and 33 are rejected under 35 U.S.C. 102(b) as allegedly anticipated by Mueller, et al. (US Patent No. 5,230,459). The rejection is respectfully traversed.

Mueller discloses a target 2 and backing plate 10 joined by filling the grooves of teeth 8 of the target 2 with the material of the backing plate 10 upon subjection of heat just below the melting point of the softer backing plate material (col. 4, lines 49-53, lines 33-37 & lines 62-64). Such temperatures are specifically disclosed in Mueller as 550-625°C (col. 4, line 62), 600°C (col. 5, line 3). Thus, Mueller discloses diffusion bonding a target to a backing plate at high temperatures. The deficient teachings of Mueller are as follows:

**Deficiencies of Mueller**

**Independent claim 1**

- (1) No suggestion of pressure consolidation at claimed temperature.
- (2) No suggestion that projections extend into and mechanically lock over the other mating surface.

**Independent claim 18**

- (1) No hint or suggestion of consolidation at the claimed temperature range.

(2) No hint or suggestion of deformation of at least one edge of the salient portion as recited, and

(3) No suggestion of the tip angle and mechanically locking grip.

In item 6 of the Office Action, claims 1, 8, 14, 18, 22, 27, 28, 30 and 33 are rejected under 35 U.S.C. 102(e) as allegedly anticipated by Hunt, et al. (US Patent No. 5,836,506). The rejection is respectfully traversed.

Hunt, et al. discloses a target 10 and backing plate 16 joined by roughening the surface of at least one of the target and backing plate (col. 5, lines 47-56), or drilling holes 28 in one of the target and backing plate (col. 6, lines 13-15) and then pressing the target and backing plate together under hot isostatic pressing or uniaxial hot pressing conditions (col. 6, lines 39-43). Table 1 in Hunt, et al. sets forth the temperatures used for forming the target/backing plate assemblies using the hot pressing methods described in Hunt, et al. Table 1 identifies the temperatures used as 60% or greater than the melting point of the backing plate material. The minimum temperature in Hunt, et al. is thus 300°C, which is eight times higher than the less than 38°C recited in claim 1 of Applicants' invention. The 60 % or greater than the melting point temperature of the backing plate of Hunt, et al. is also exactly contrary to the less than 50% of the lower melting point of the lower of the target and backing plate recited in claim 18 of Applicants' invention. Further, neither the roughening nor the holes in Hunt, et al. teach or suggest forming the mechanical lock between the target and backing plate using the edge and projection tip of salient portions of one of the target and backing plate extending into the other at first and second re-entrant angles as recited in claim 28 of Applicants' invention. Accordingly, Hunt, et al. fails from the following deficiencies:

#### **Deficiencies of Hunt**

##### **Independent claim 1**

(1) No suggestion of the low (i.e. less than 38°C) temperature pressure consolidation.

- (2) No suggestion of projections that extend into and mechanically lock over the other of the mating surfaces.

Independent claim 18

- (1) No suggestion of consolidation temperature range.
- (2) No suggestion of deformation such that at least one edge of the salient portion forms a re-entrant edge angle wherein the tip forms an angled mechanical locking grip over the other material.

Independent claim 28

- (1) No suggestion of a first and second re-entrant angled edge and tip respectively.

Independent claim 34

- (1) No suggestion that salient portion extends back toward the other mating surface, and
- (2) No suggestion of pressure consolidation under low temperature conditions.

In item 7 of the Office Action, claims 1, 8 and 27-29 are rejected under 35 U.S.C. 102(e) as allegedly anticipated by Zhang (US Patent No. 6,071,389). The rejection is respectfully traversed.

Zhang was subject to an obligation of common assignment to the assignee of the present invention at the time the present invention was made. Thus, under 35 U.S.C. 103 (c ), Zhang is not available as prior art to preclude patentability of this invention. Accordingly, withdrawal of the 35 U.S.C. 102(e) rejection of claims 1, 8 and 27-29 is respectfully requested.

In item 9 of the Office Action, claims 2, 3 and 32 are rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Mueller, et al. in view of Pierce, et al. (US Patent No. 4,385,979). The rejection is respectfully traversed.

Pierce, et al. is allegedly applied for teaching the step of bonding the periphery of the target and backing plate assembly prior to pressing the assembly under the low temperature of claims 2 and 3, and for allegedly teaching the "M" shaped ridges

comprising the salient portions of the target and backing plate of claim 32. Pierce, et al., however, teaches retaining a target to a bottom plate by providing a bonding agent 215 securing a planar bottom surface of a target 212 to a planar bottom plate 222 (col. 11, lines 44-49), or a threaded member 165 and angled surface 463 (Fig. 4), or stepped portions 662, 663 (Fig. 6) securing the target/backing plate assembly to a bottom plate. Nowhere does Pierce, et al. teach or suggest bonding the periphery of a target and backing plate in addition to pressure consolidating the assembly at low temperatures less than 38°C, as recited in claims 1, 2 and 3 to form a mechanical lock between the target and backing plate. Nor does Pierce, et al. teach or suggest the "M" shaped ridges recited in claim 32, or the mechanical lock formed by first and second re-entrant angles of an edge and projection tip as recited in claim 28. Thus, neither Mueller nor Pierce, et al, singly or in combination, teach or suggest the combination of features recited in claims 2, 3 and 32. Accordingly, withdrawal of the 35 U.S.C. 103(a) rejection of claims 2, 3 and 32 based on the combination of Mueller, et al. and Pierce, et al. is respectfully requested.

In item 10 of the Office Action, claims 2, 3 and 32 are rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Hunt, et al. in view of Pierce, et al.. The rejection is respectfully traversed.

Applicants' invention with respect to claims 1 and 28 is discussed above. Hunt, et al. is discussed above and fails to teach the low temperature of less than 38°C recited in claim 1, or forming the mechanical lock between the target and backing plate using the edge and projection tip of salient portions of one of the target and backing plate extending into the other at first and second re-entrant angles as recited in claim 28 of Applicants' invention. Pierce, et al. is also discussed above, and fails to overcome the deficiencies of Hunt, et al.. Thus, neither Hunt, et al., nor Pierce, et al, singly or in combination, teach, disclose or suggest the combination of features recited in claims 2, 3 and 32. Accordingly, withdrawal of the 35 U.S.C. 103(a) rejection of claims 2, 3 and 32 based on the combination of Hunt, et al. and Pierce, et al. is respectfully requested.

In item 11 of the Office Action, claims 7, 24, 25 and 29 are rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Hunt, et al. in view of Pierce, et al. The rejection is respectfully traversed.

Applicants' invention with respect to claims 1, 18 and 28 are discussed above. The combination of Hunt, et al. and Pierce, et al., as discussed above, fails to teach or suggest the combination of features recited in claims 1 and 28, from which claims 7 and 29 depend, respectively. Further, as discussed earlier, Hunt et al., teaches away from a temperature of less than 50% of the melting temperature of the lower melting temperature material of the target and backing plate as recited in claim 18. Pierce, et al. is silent with respect to temperature to achieve bonding. Thus, Hunt, et al., and Pierce, et al., singly or in combination, fail to teach, disclose or suggest the combination of features recited in claims 1, 18 and 28, from which claims 7, 24, 25 and 29 depend. Quamar, meanwhile, teaches friction fitting a target having a diameter 16 fitting into a bore diameter 46 of a backing plate 40, and then welding an angled side wall of a target to an angled side wall of a backing plate using a filler 30 (Figure 3) to even better secure the target to the backing plate. Like Hunt, et al. and Pierce, et al., Quamar fails to teach or suggest the temperatures of claims 1 and 18, or the mechanical lock of claim 28. Accordingly, withdrawal of the 35 U.S.C. 103(a) rejection of claims 7, 24, 25 and 29 based on the combination of Hunt, et al. and Pierce, et al. (and Quamar, if intended) is respectfully requested.

In item 12 of the Office Action, claims 23 and 31 are rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Hunt, et al. in view of Pierce, et al and Dunlop, et al. (JPN 06-065733 A). The rejection is respectfully traversed.

Applicants' invention is discussed above with respect to claims 18 and 28, from which claims 23 and 31, respectively, depend. Likewise, Hunt, et al. and Pierce, et al. are discussed above. Both of claims 18 and 28 recite specific edge and tip angles to achieve the mechanical locking grip of a target and backing plate. Dunlop is applied for teaching the Cu or Cu alloy target recited in claims 23 and 31. Dunlop however fails to disclose the edge and tip angles recited in claims 18 and 28, from which claims 23 and



31 depend, respectively, in order to achieve the mechanical locking of the target and backing plate to one another. Rather, Dunlop discloses a target and backing plate, one of which is provided with grooves that enter the other of the target and backing plate at temperatures just below the melting point of the non-grooved one of the target and backing plate. Thus, Dunlop fails to overcome the deficiencies of the combination of Hunt, et al., and Pierce, et al. with respect to claims 18 and 23. Accordingly, withdrawal of the 35 U.S.C. 103(a) rejection of claims 23 and 31 based on the combination of Hunt, et al., Pierce, et al., and Dunlop is respectfully requested.

In item 13 of the Office Action, claims 6 and 9 are rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Mueller, et al, in view of Pierce, et al. and Stellrecht (US Patent No. 5,324,496). The rejection is respectfully traversed.

Applicants' invention with respect to claim 1 is discussed above. Claim 6 recites the step of friction welding the periphery of the target and backing plate, and claim 9 recites the backing plate as Al, stainless steel, Cu, Ti or their alloys.

The combination of Mueller, et al. and Pierce, et al., with respect to claim 1, is discussed above such that Mueller, et al. fails to teach or suggests joining the target and backing plate at low temperatures of less than 38<sup>0</sup>C as recited in claim 1 of Applicants' invention, and Pierce, et al. fails to teach or suggest the same.

Stellrecht, applied for friction welding a target and backing plate of particular materials together (col. 4, lines 40-45), nevertheless fails to teach or suggest doing so at the low temperature of less than 38<sup>0</sup>C recited in claim 1 of the Applicants' invention, from which claims 6 and 9 indirectly depend. Further, Stellrecht does not teach mechanically locking the target and backing plate together by at least one of a plurality of salient portions of one of the target and backing plate extending into and locking with the other of the target and backing plate as recited in claim 1. Nor is there any motivation in Stellrecht to provide such a mechanical locking of the target and backing plate as the friction fit alone is that which joins the target and backing plate in Stellrecht. Thus, neither Mueller et al, Pierce, et al., nor Stellrecht, singly or in combination, teach, disclose or suggest the combination of features recited in claim 1,

from which claims 6 and 9 indirectly depend, of Applicants' invention. Accordingly, withdrawal of the 35 U.S.C. 103(a) rejection of claims 6 and 9, based on the combination of Mueller, et al., Pierce, et al., and Stellrecht, is respectfully requested.

Reconsideration of the application, in view of the amendments and remarks made herein, is respectfully requested. Applicants earnestly contend that all claims presented are in full conformity with the patent statute and accordingly, allowance of claims 1-40 is respectfully solicited.

Should the Examiner determine that anything else is desirable to place this application in even better form for allowance, the Examiner is respectfully requested to contact the undersigned at the telephone number below.

Respectfully submitted,

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